

# THE TREATMENT OF DELIRIUM TREMENS BY SPINAL PUNCTURE, STIMULATION AND THE USE OF ALKALI AGENTS\*

BY HERMAN H. HOPPE, A.M., M.D.

CINCINNATI, OHIO

The routine treatment of delirium tremens for many years has been catharsis, restraint and sedatives. In many places and in private practice this treatment is the rule to-day. Many years ago digitalis was for a time advocated as a specific remedy, but its use was abandoned up to a few years ago, when it was advocated once more.

Two years ago, R. Steinbach, rather accidentally, in withdrawing the cerebro-spinal fluid in a case of delirium with fixed pupils, for the purpose of making a Wassermann test, found that the patient's condition improved very remarkably, and continued to treat eighteen other cases by spinal puncture, with rather good results. After the opening of the Cincinnati General Hospital in 1915 the delirium tremens cases were sent to the psychopathic wards instead of the strong ward and transferred from the medical to the nervous and mental department. An attempt was made to treat these cases on a basis of their pathology and I wish to put on record the results obtained by this treatment during the year 1916.

Delirium tremens is an acute exhaustion psychosis developed upon the basis of chronic alcoholism. Considered from the standpoint of pathological anatomy we have, first, the changes in the brain, the heart and the blood-vessels and intestinal tract which are characteristic of chronic alcoholism, and secondly an acute condition of the meninges which is occasioned by the presence perhaps of an intermediate poison which has found its way into the cerebral circulation. The simultaneous occurrences of cellular changes in the cortex of the brain, together with changes in the pia, are the underlying anatomical factors which produce delirium tremens.

The cellular changes are perhaps of prime importance in the production of the delirium. These changes are more manifest in the cells of the cortex and are rather uniform.

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They are : i. In the early stages of chronic alcoholic degeneration, the dendrites of the ganglionic cells lose their granular appearance and become smooth and bare.

ii. If these changes continue to progress, the dendrites break up and disintegrate.

iii. The cell body at first is swollen, then becomes vacuolated, degenerates and becomes atrophic.

If these cell changes have not progressed very far it is presumed that the cells can return to a normal condition.

In a macroscopic way the most noticeable change in delirium tremens is the so-called wet brain. We have been told, as we shall see later, that this is a misnomer. The brain itself is rather deficient in fluid, but the pia mater is edematous and we really have a serous meningitis. The meshes of the pia are full of serum; there is some increase in the number of leucocytes and old cases show a tendency to increased connective tissue formation, more especially along the course of the larger vessels. There may be perhaps an increased secretion of the cerebro-spinal fluid, but the greatly increased quantity of fluid is probably caused by a serous meningitis. The cerebro-spinal fluid itself is found increased in nearly all the cases which have been under treatment. Steinbach found an absence of this increased pressure in 25 per cent. of cases. I believe that in our cases the percentage is much lower. Our experience has been the same as that of other observers, viz., that this increase of cerebro-spinal fluid continues during the whole course of the disease; for in all of the cases of repeated punctures, the cerebro-spinal fluid has always been found under increased pressure. The fluid itself is apparently normal, no largely increased number of cells are to be found. In this respect delirium tremens differs from ordinary chronic alcoholism or alcoholic psychoses. The cerebro-spinal fluid in the few cases of chronic alcoholic dementia in which spinal puncture has been made is never under pressure, whereas the cell count is slightly increased.

Slight quantities of alcohol are at times found in the cerebro-spinal fluid (Steinbach), but this has no relation to the development of delirium tremens.

Nuzum and Count publish the result of a series of experiments on the ability of the brain tissue to take up water after death. They come to the conclusion that in delirium tremens the brain colloids take up a very much larger percentage of water than normal brains of individuals who have died from accidents. They conclude that this ability to take up water is due to a cell asphyxia.

Cell asphyxia in delirium tremens is due perhaps to three factors :

i. Impaired circulation caused partly by the direct effect of the alcohol on the vessels, and partly by the pressure of the increased cerebro-spinal fluid. Cardiac weakness caused by alcoholism plays an important rôle, a deficient quantity of blood being brought to the brain.

ii. The impaired vitality of the cells of the cortex due to either the direct action of the alcohol or to the toxine which is developed in the intestinal tract in alcoholism.

iii. Alcohol is a narcotic and as such produces cell asphyxia.

The cortical cells are therefore narcotized by the alcohol, poisoned by a toxin and underfed by a deficient circulation. According to Prof. Martin Fisher the result of cell asphyxia is the development of an acidosis.

This abnormal state of the ganglionic cells of the cerebral cortex is caused by a similar degeneration of practically all the cells of the body, more especially, however, of those of the heart, the kidneys and the intestinal tract. In the circulatory apparatus this cellular degeneration results in a weakness of the heart muscle, as well as the muscle of the arterial walls, causing a passive hyperemia. In the kidneys the combination of cellular degeneration and passive congestion leads to a deficiency of elimination. Similar changes in the intestinal tract lead ultimately to the formation of the intermediate toxin, which is supposed to be the direct cause of delirium tremens (Bonhoeffer).

As long as this toxin can be eliminated by the kidneys with the help of the circulatory apparatus conditions are fairly normal. As soon however as elimination fails we have cerebral edema, an increase of cerebro-spinal fluid, cortical ganglionic cell asphyxia, acidosis and then delirium tremens.

The underlying causal factors are therefore the development of a toxin, a weakened heart and circulation, a deficiency of elimination by way of the kidneys, then edema of the meninges and increased pressure of the cerebro-spinal fluid.

These factors call for a treatment by elimination, stimulation of the circulatory apparatus and in at least one half of the cases, the removal of the pressure on the brain and cerebral circulation. Following is the routine treatment :

i. Catharsis is used as a routine measure, calomel, followed by a rather large dose of Epsom salts. The latter is especially indicated because of the well-known effect of sulphate of magnesium in dehydrating the tissues of the body.

ii. Tr. digitalis and Tr. nuc. vomica gtt. x are given by the mouth every three hours. In the active state of delirium strychnine and digitaline are given hypodermatically. We believe that this stimulation is perhaps the most essential part of the treatment, for whereas many if not most cases show an increase of blood pressure on admittance, the pressure drops very rapidly during the course of the delirium and dangerous weakness of the heart develops frequently, as a result of the excessive muscular activity.

iii. In mild cases the indication for alkalies is met by the use of the imperial drink with lemon juice.

Prolonged hot baths and hot packs are given twice a day, chloral and bromides are given only at night, and then not more than 2-3 doses during the twelve hours.

In the ordinary mild cases of delirium tremens, uncomplicated with kidney trouble, the above treatment is sufficient and the disease runs a very mild course.

In the more severe cases, and at present as a routine treatment, spinal puncture is resorted to as soon as the patient begins to have hallucinations. The cerebro-spinal fluid is always under pressure and from 30 to 60 c.c. is usually withdrawn. The withdrawing of the fluid is followed by a rapid reduction of the delirium, especially in cases which have had preliminary stimulation and alkalinization. If the delirium returns spinal puncture is repeated and the fluid is usually found to be again under pressure. In this respect our findings agree with those of Steinbach, who says that the increased pressure of cerebro-spinal fluid continues during the whole course of the disease. If the delirium still continues notwithstanding the spinal puncture, or if the patient is pale and covered with perspiration with a low muttering delirium, an intervenous injection of normal saline solution is given, or what we have found to be of more use, especially in cases with frequent convulsions and deficient kidney function, Fisher's solution.

We have had much experience with Hogan's method of treatment. We believe it to be of much value, and use it when the above method fails.

The prolonged warm baths and packs not only have a sedative action, but remove large quantities of fluid from the system and help to eliminate the intermediate toxin. They also help to remove the pressure from both brain and kidney.

The treatment may be said ultimately to be based upon the effort to remove the cell asphyxia and the acidosis of all the tissues, especially that of the brain cells, by improving the circulation, introduc-

ing dehydrating alkalies into the blood current and enabling the latter to reach the brain cells, by removing the pressure through spinal puncture. Chloral and bromides should be used as little as possible, and only in bad cases of extreme delirium, because like all sedatives they increase cell asphyxia and acidosis.

Cases have been treated according to this method during a part of the year 1915, the entire year 1916 and during the present year. I will confine myself to an analysis of the results obtained during 1916 because of the fact that it is only fair to take a whole year, rather than a part of a year.

During 1916 129 cases, either in the actual state of delirium tremens or so-called borderland cases with beginning delirium, were admitted to the psychopathic ward. This number comprises all, diagnosed clinically as complicated and uncomplicated. None of these complications were surgical complications. Of this number, 14 cases died, and I hereby show a table of the pathological causes of death. The mortality therefore from all causes was 10.8 per cent.

Clinical Diagnosis	Autopsy Diagnosis
Acute alcoholism .....	Fracture base skull; congestion brain and lungs; fatty liver.
Acute alcoholism .....	Congestion lungs; chronic nephritis.
Acute alcoholism; lobar pneumonia .....	Lobar pneumonia; fatty liver; acute nephritis.
Chronic alcoholism .....	Cellulitis leg; dilatation heart; chronic interstitial nephritis; congestion lungs; sepsis.
Chronic alcoholism; multiple neuritis .....	Edema brain; acute nephritis.
Chronic alcoholism; lobar pneumonia; chronic nephritis .....	Lobar pneumonia; pleuritis; chronic nephritis; dilatation heart.
Delirium tremens .....	Edema brain and lungs; chronic nephritis; fatty liver.
Delirium tremens .....	Chronic tuberculosis; tuberculous enteritis; pseudo-oesophagitis.
Delirium tremens .....	Edema brain and lungs; endocarditis; fatty liver; chronic nephritis.
Delirium tremens .....	Leptomeningitis; acute nephritis; fatty liver; edema lungs.
Delirium tremens; serous meningitis .....	Edema brain; dilatation heart; edema lungs; chronic nephritis.
Delirium tremens; omental hernia.	Chronic interstitial nephritis; edema lungs; omental hernia; fatty heart.
Delirium tremens; lobar pneumonia .....	Lobar pneumonia; dilatation heart; fatty liver; chronic nephritis.

Of the 129 cases, 24 had clinical complications, usually chronic Bright's disease in some form. Of the other 105 cases, which seemed clinically uncomplicated, 8 cases died, a mortality of 7.6 per cent.

I would like to compare these figures with those of the 10 years, preceding 1915, when the routine treatment was catharsis and sedatives. During these ten years 903 cases of delirium tremens, not counting those complicated with surgical conditions, were treated. Of these 903 cases, 234 died, a death rate of 25.9 per cent. compared to a death rate of 10.8 per cent. under the treatment outlined in this article. 89 deaths in the 234 were clinically assigned to complications. 783 cases, however, during these 10 years were considered clinically as uncomplicated and of these 114 died, a mortality of 18.5 per cent. as compared to 7.6 per cent. in the clinically uncomplicated cases treated according to the above method.

If we consider the figures, however, from another point of view, we will have a clearer value of the treatment. Ordinary cases of drunkenness or even doubtful cases are not sent to the psychopathic ward. Only when there is good reason to believe that delirium tremens is impending, or that it is actually present, are the patients sent from the receiving wards to the psychopathic service. Of 375 cases admitted, 27 cases died, with a mortality of 7 per cent. Of these 375 cases, only 114 cases actually developed delirium tremens. 264 cases being aborted, 59 cases developed only mild delirium tremens, of which only 2 cases died. Sixty-seven cases were looked upon as severe cases and were treated by spinal puncture. Of these 25 cases were aborted and did not develop typical delirium tremens. All severe cases complicated with chronic Bright's or pneumonia were subjected to spinal puncture as well as to the intravenous treatment with normal saline solution or Fisher's solution; often as a last resort.

The pathological table will show the hopelessness of most of the cases that died during 1916, and that death was due to such advanced stages of degeneration of the heart and kidneys as to render any treatment unavailing.

Beginning with January, 1917, spinal puncture has been used in every case of delirium tremens admitted to the service, the rule being to apply the treatment as soon as any hallucination becomes manifest.

Hogan's method of treatment has been used only in the exceptionally severe cases and with very much success, apparently hopeless cases recovering quite frequently. I am favorably impressed with the method, but it is far more complicated and requires very much more time than the comparatively simple treatment outlined above.

I believe that the cases treated are sufficiently large in number

to allow us to draw conclusions as to the value of the treatment. When we consider that the cases treated in a large general hospital are usually the worst of the class, cases which cannot be kept at home or in private hospitals, we can readily see that we are dealing with the most acute cases, as well as those most likely to have complications on part of the heart and kidneys.

We may summarize as follows:

- i. The treatment is a rational treatment, based upon the pathology of the disease.
- ii. It renders the course of the disease shorter and milder.
- iii. Only thirty per cent. of the cases developed manifest delirium tremens.
- iv. The cases are easier to nurse, the ward being in charge of female nurses with one male orderly, and the cases are less noisy and not so objectionable to other mental cases in the psychopathic ward.
- v. The treatment by spinal puncture is devoid of danger and can be carried out by the average interne of a hospital.
- vi. Many complications such as myocardial collapse and uremia are forestalled by the routine treatment.
- vii. The death rate is greatly reduced.

#### BIBLIOGRAPHY

1. R. Steinbach. *Deutsch. med. Wochenschr.*, 1915, No. 13, p. 369.
2. Bonhoeffer. *Mschr. f. Psych.* 1.
3. Frank Nuzum, M.D., and E. R. Le Count. The Ability of Brain Tissue to take up Water. *Delirium Tremens and Other Conditions. A study of Cerebral Edema.* *Jour. Am. Med. Assn.*, December 16, 1916.
4. James J. Hogan. The Treatment of Acute Alcoholic Delirium. *Journ. Am. Med. Assn.*, December 16, 1916.
5. Martin Fisher. *Edema and Nephritis.*